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Title:	Slides for upcoming inter-laboratory round robin discussions
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Intended for:	discussion/presentation of results obtained at multiple participating laboratories of a recent inter-laboratory measurement round robins
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Slides for upcoming inter-laboratory round robin discussions

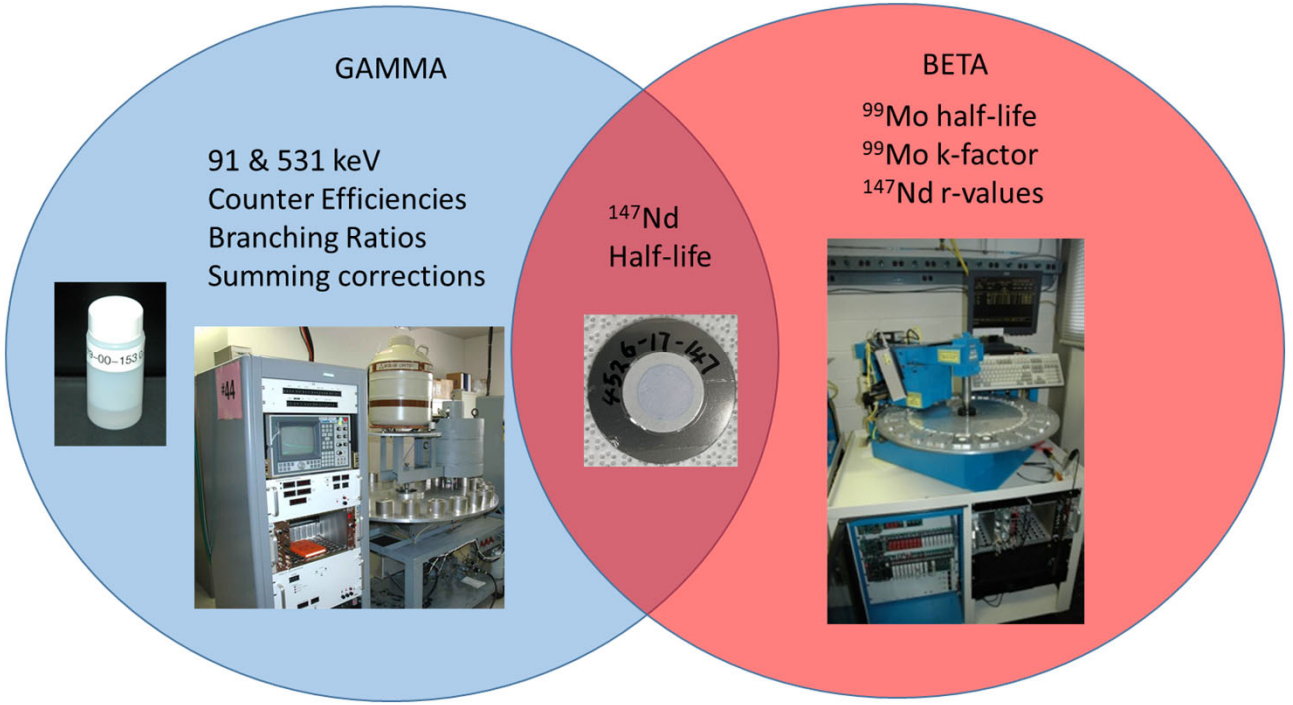
Iain May and Susan Hanson

^{147}Nd Results – LANL

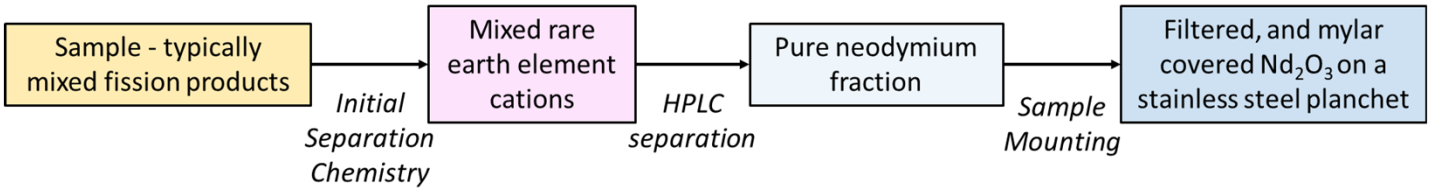
M. Dembowski, A.J. Gaunt, I. May & N.C. Smythe (Radiochemistry) and M.R. James, C.A. Lance, R.J. Rendon, J.R. Romero (Counting)

Method	dpm/gA	± %
Solution gamma	1.23E6	2.4
Separated gamma	1.26E6	2.5
Separated beta (no absorber)	1.26E6	2.4
Separated beta (absorber)	1.25E6	2.8

Gamma-ray spectrometry and beta counting



Beta Counting – Radiochemistry and Counting Methodology

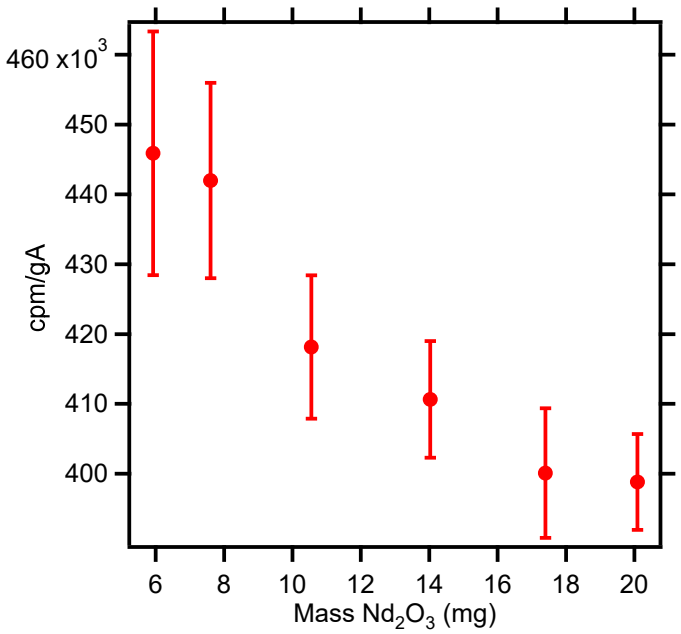


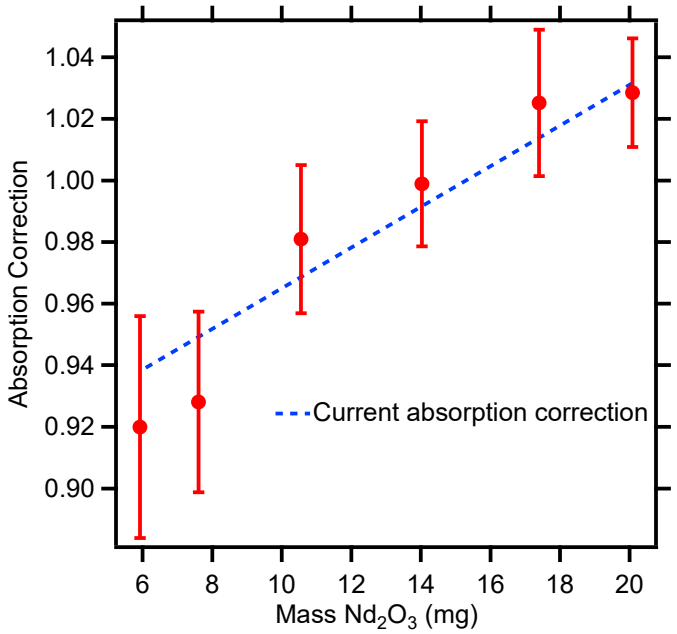
^{147}Nd 'r' values generated with & without aluminum absorber (without & with ^{147}Pm)

$$^{147}Nd\ r = \frac{^{147}Nd\ cpm\ (^{235}U - thermal)}{^{99}Mo\ cpm\ (^{235}U - thermal)}$$

$$^{147}Nd\ K - factor\ (atoms/cpm) = \frac{^{99}Mo\ K - factor\ (fissions/cpm)}{^{147}Nd\ r_{(^{235}U - thermal)}} \times\ ^{147}Nd\ FY(^{235}U - thermal)$$

Absorption Correction Measurements
Good Agreement with Current Correction Equation



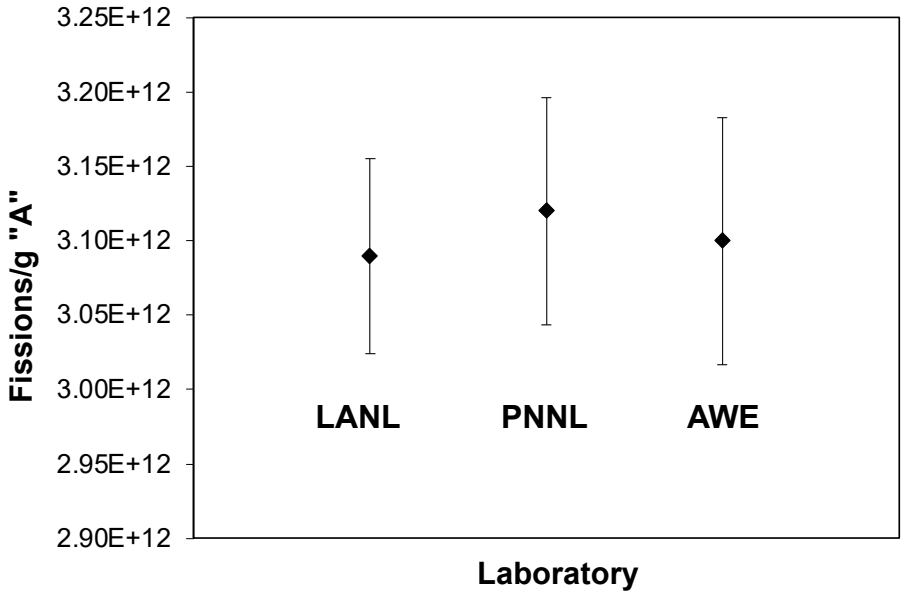


Main Findings

- Beta counting k-factor methodology used to determine activity/atoms
  - Both with/without an aluminum absorber (without/with weak beta emitting ^{147}Pm)
- Gamma-ray spectrometry measurements in good agreement with beta measurements
- Gravimetric yielding is the biggest contributor to the separated sample uncertainty budget
  - If lower uncertainties required chemical procedures can be developed to increase final masses

Total fissions per gram “A” measured at each laboratory

- LANL = 3.09E12 ± 2.12% (Mo-99 beta)
- PNNL = 3.12E12 ± 2.44% (Mo-99 gamma whole A)
- AWE = 3.10E12 ± 2.68% (Mo-99 gamma whole A)
- LLNL pending
- CIL pending



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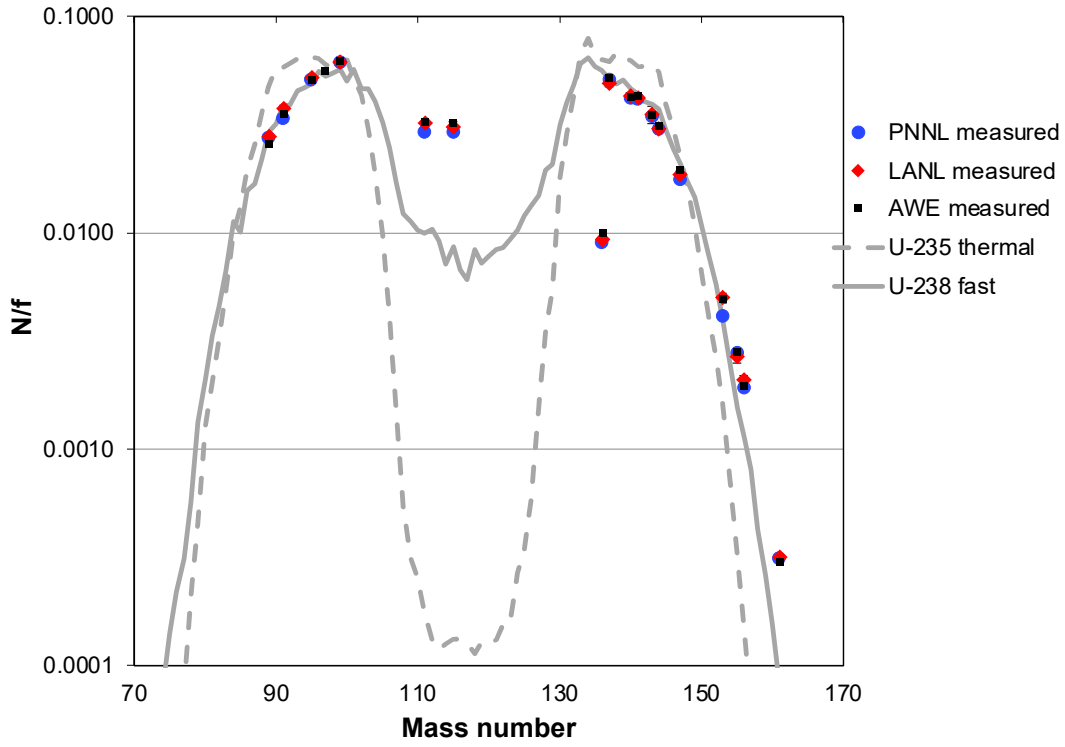
Fission product distributions for non-thermal sample



Laboratory	Measured ^{161}Tb R-value
LANL	371 ± 2.8%
PNNL	383 ± 3.8%

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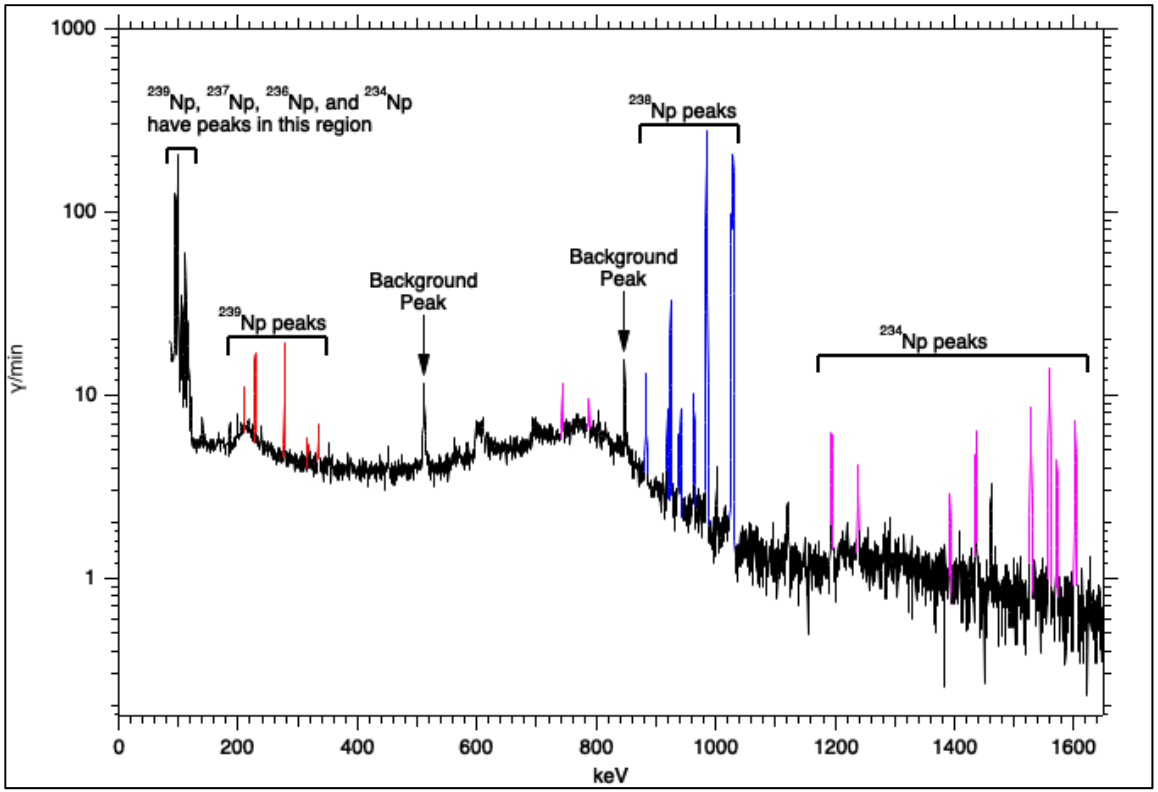
Unusual actinide isotopes measured

- In addition to ^{239}Np, ^{238}Np and ^{234}Np were measured by gamma spectrometry at LANL and PNNL.
- Alpha spectrometry indicated that ^{235}Np, ^{238}Pu, and ^{236}Pu were also present.



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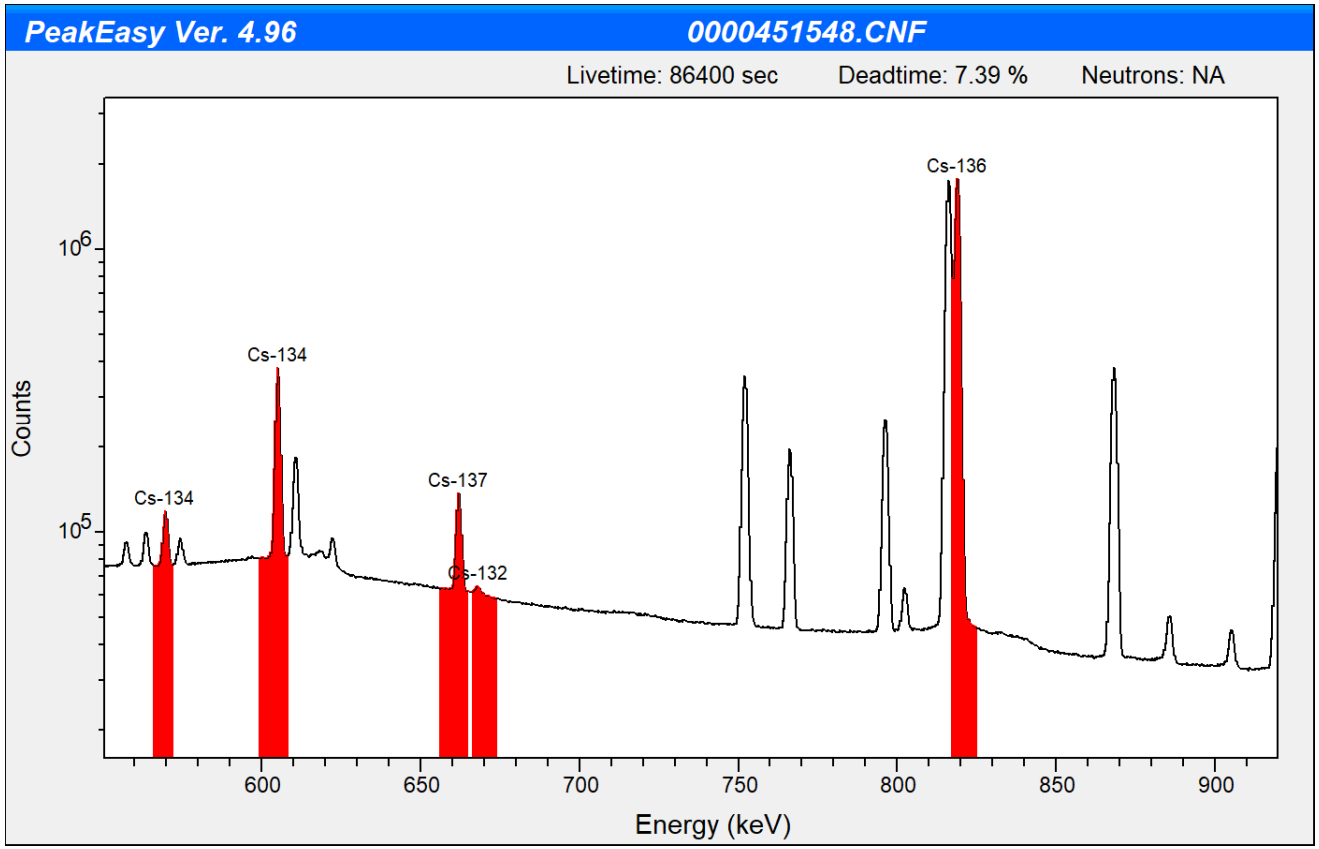
Unusual isotopes confirmed at multiple laboratories

Cs-132 @ 667.8 keV

Detected at both LANL and PNNL

Production mode unclear



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Conclusions

- A successful inter-laboratory round robin in summer 2021, enabling comparison of fission product measurements in a non-thermal spectrum
- The experiment allowed each laboratory to measure the standard set of fission products and short-lived actinides, as well as many unique isotopes
- The extreme elevations in wing and valley isotopes exceed anything expected for a nuclear detonation
- Discussions to identify and plan more realistic future fission product exercises are planned